

**METHOD OF FORMING COBALT SILICIDE FILM AND METHOD OF  
MANUFACTURING SEMICONDUCTOR DEVICE HAVING COBALT SILICIDE  
FILM**

**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This is a continuation-in-part of U.S. Patent Application No. 10/457,449, filed June 10, 2003, <sup>now abandoned</sup> the entire contents of which are incorporated herein by reference. In addition, a claim of priority is made to Korean Patent Application Nos. 2002-63567 and 2003-66498, filed October 17, 2002 and September 25, 2003, respectively, the entire contents of which are incorporated herein by reference.

**BACKGROUND OF THE INVENTION**

**1. Field of the Invention**

[0002] The present invention generally relates to the fabrication of semiconductor devices, and more particularly, the present invention relates to a method of forming a cobalt silicide film and to a method of manufacturing a semiconductor device having a cobalt silicide film.

**2. Description of the Related Art**

[0003] As the gate resistance and source/drain contact resistance of a metal oxide semiconductor (MOS) increases, the operation speed of a semiconductor device containing the MOS transistor decreases. Accordingly, silicide films have been widely used to decrease these resistances. Cobalt silicide films, in particular monocobalt disilicide ( $\text{CoSi}_2$ ) films, are especially useful in view of their low resistance (16 to 18  $\mu\Omega\text{ cm}$ ), good thermal stability, and reduced sheet resistance ( $R_s$ ) dependency to size. Cobalt silicide films have been used in static random access memory (SRAM) devices and in logic devices that require high operation speeds.

[0004] A cobalt silicide film having poor characteristics can result if impurities such as silicon oxide and silicon nitride are present at a surface of a silicon region on which the cobalt silicide film is formed. For this reason, prior to deposition of the cobalt silicide film, a substrate surface is conventionally wet-cleaned and then